



Use Impairments from Algal Blooms in Green Bay

Victoria A. Harris
UW Sea Grant Institute

HAB Workshop
March 22, 2007
KI Convention Center

Water defines life in Wisconsin

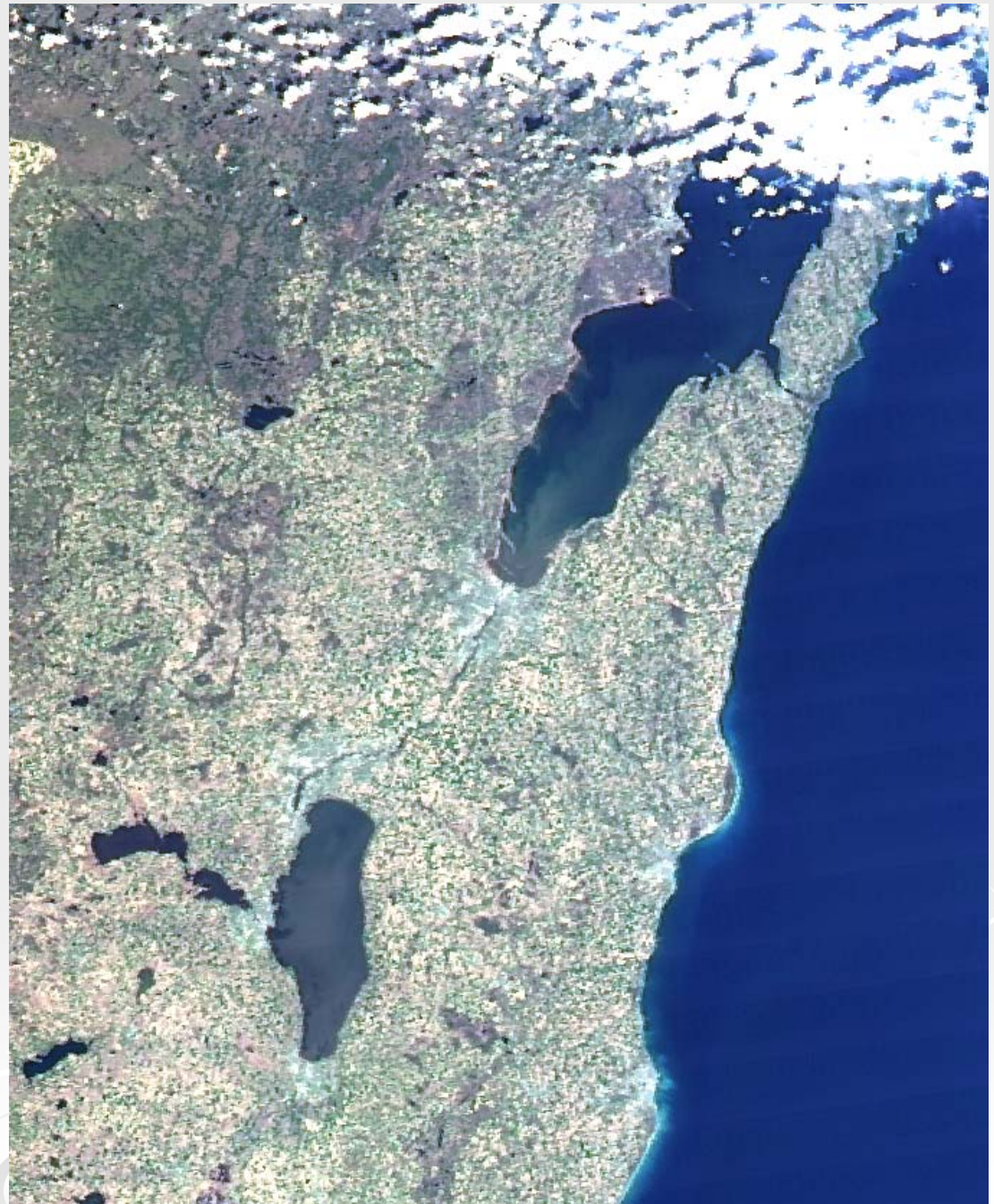


- Our landscape, history, cultures, communities, ecosystems, and economy are fundamentally shaped by water
- Water is an essential element of life, an inherent part of who we are, and of the places we care about
- Clean water – There is no substitute!
- Problems with frequency and duration of nuisance and harmful algal blooms in Lake Winnebago, Fox River and lower Green Bay
- Reminiscent of conditions prior to CWA

- March 26
2006
- Modis
Satellite
Images from
ERSC, UW-
Madison



➤ April 26 2006



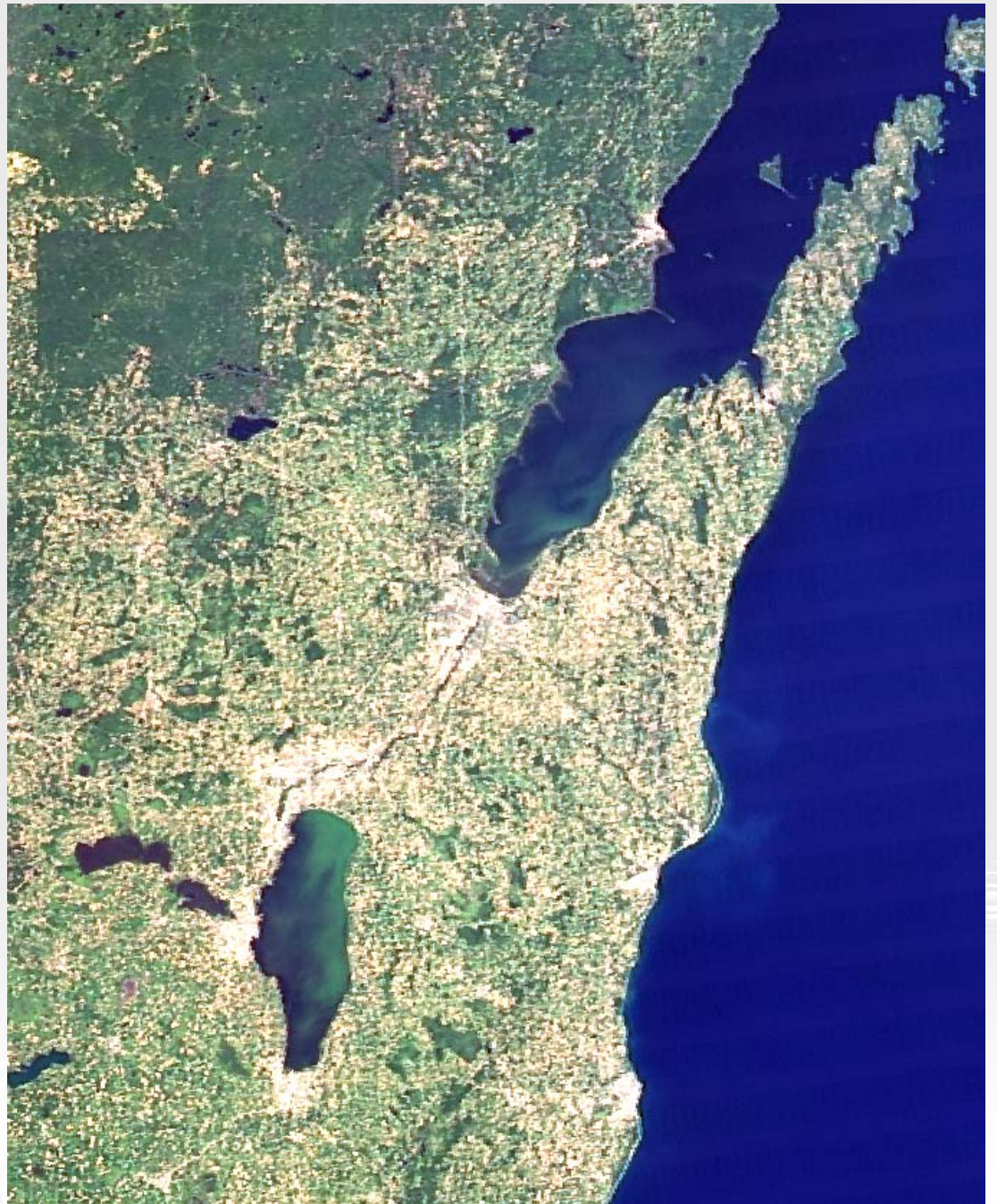
➤ May 23 2006



➤ June 30 2006



➤ July 15 2006



➤ August 4 2006



➤ August 20 2006



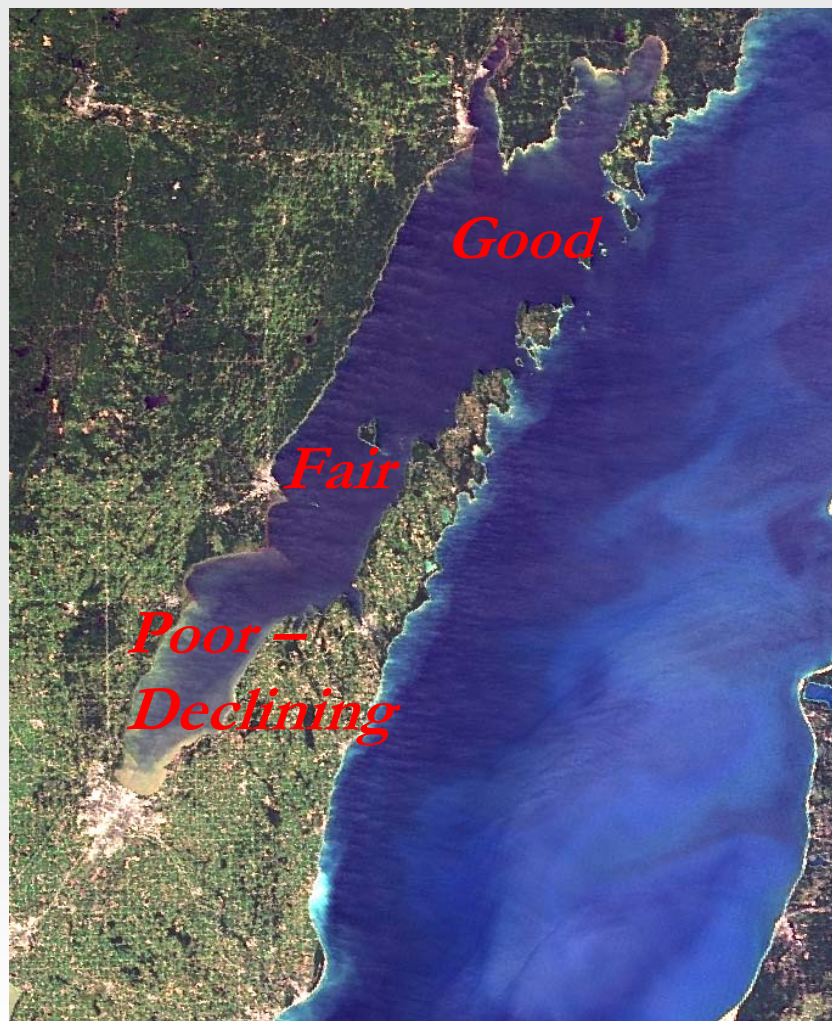
➤ September 14
2006



➤ October 6 2006



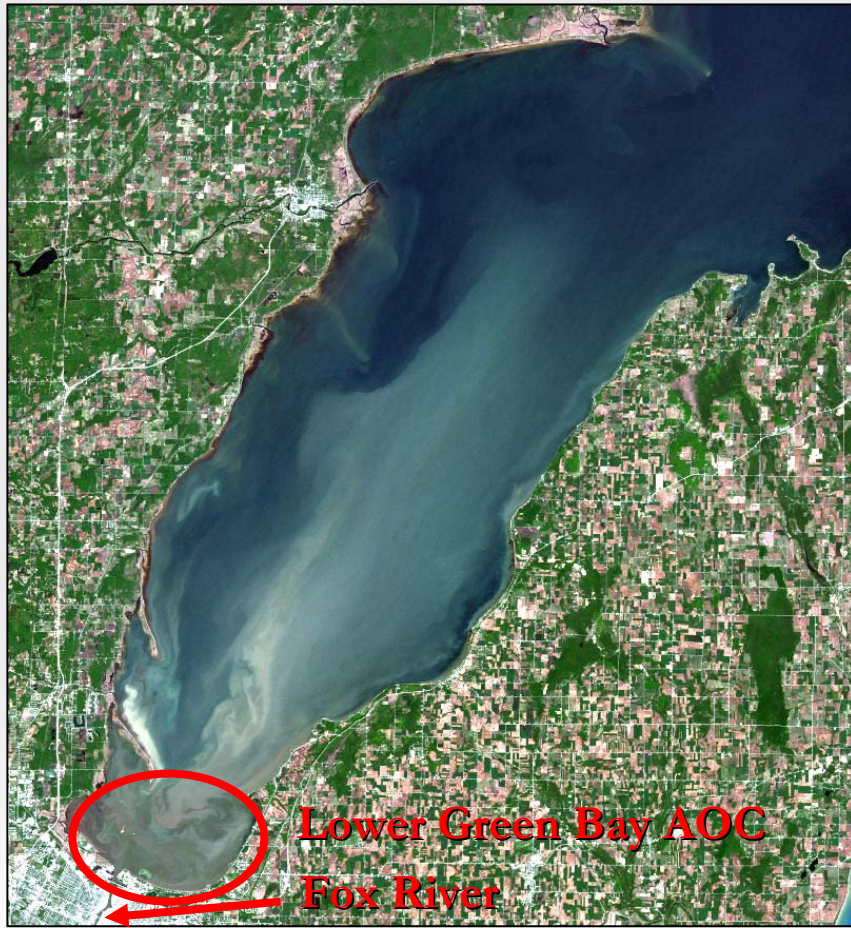
State of Green Bay



ERSC, UW-Madison

- Largest of lake's bays, but much shallower, warmer and eutrophic
- Flushing time
 - Lake Michigan 99 yrs.
 - Green Bay < 1 yr.
- Fox-Wolf River basin contributes the largest proportion of pollutants to Green Bay and Lake Michigan
 - 26% of TP tributary load to Lake Michigan
- Water quality status - poor grading to good

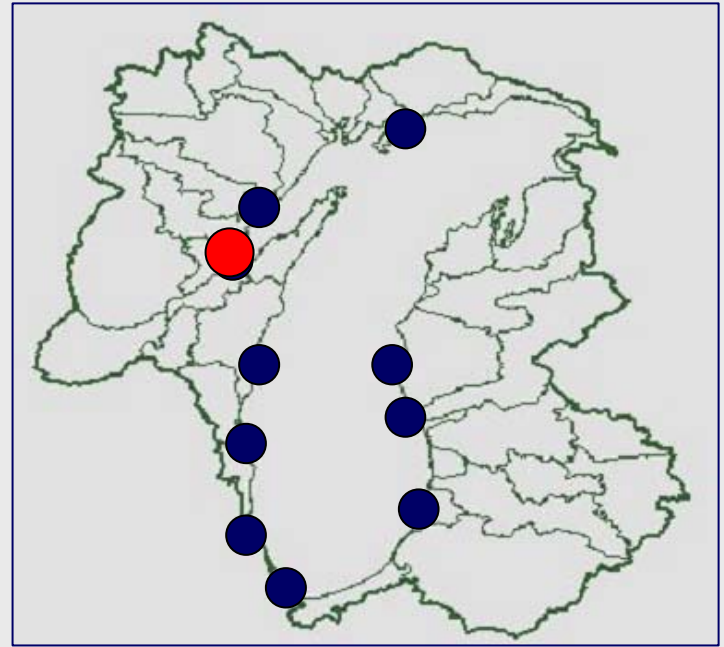
Green Bay's Trophic Gradient



ERSC, UW-Madison

- Hypereutrophic conditions in the southern bay, mesotrophic conditions in the middle bay, oligotrophic conditions in the northern bay, similar to Lake Michigan
- Trophic Indicators in lower Bay
 - TP – Status poor
 - TSS – Status poor
 - Chlorophyll – Status poor
 - Water clarity – Status poor
- Area Of Concern (AOC)

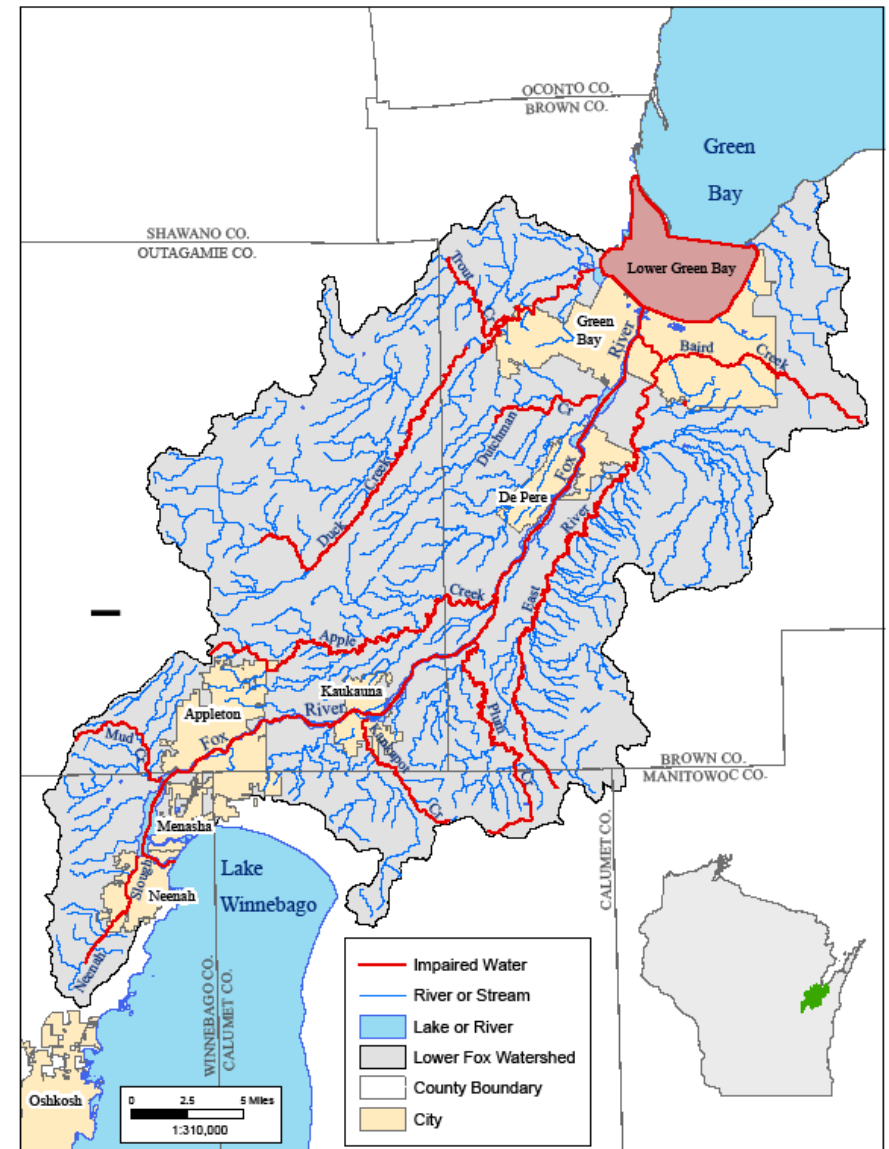
Great Lakes Water Quality Agreement



- Restore chemical, physical and biological integrity of Great Lakes ecosystem
- Identify “Areas of Concern”
geographic areas where Great Lakes beneficial uses are prohibited or impaired
- States and Provinces prepared Remedial Action Plans (RAPs)
- Agreement under review

Fox River Impaired Waters

- 303 (d) List
- Waters not meeting water quality standards or designated aquatic life uses
- Phosphorus standards must be set by 2008
- Various impairments, mostly problems with nutrients, SS, DO and habitat degradation
- TMDLs mandated



Impaired Uses due to TP and TSS in Lower Green Bay

- Nuisance and harmful algal blooms
- Poor aesthetics, closed beaches
- Lost tourism, lower property values
- Taste and odor problems for drinking water
- DO fluctuations, hypolimnetic anoxia, periodic fish kills
- Ammonia toxicity in sediments
- Poor water clarity, loss of SAV
- Altered food webs, degraded benthic, fish and wildlife communities



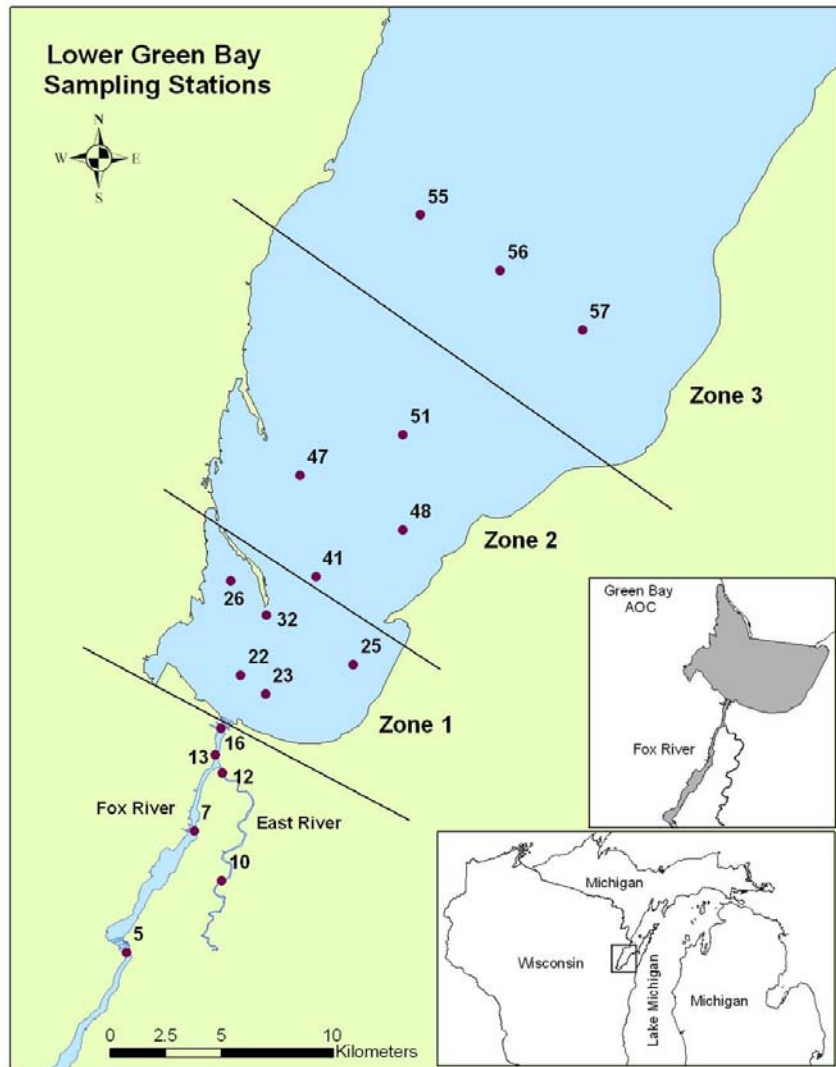


RAP targets to restore safe swimming, SAV,
and other beneficial uses

| Secchi (m) | Chlorophyll <i>a</i> (ug/l) | TP (ug/l) | TSS (mg/l) |
|-------------------|--|------------------|-------------------|
| .7 - 1.3 | 13-32 | 53-107 | 7-14 |

Values may be revised based on continuous monitoring data.

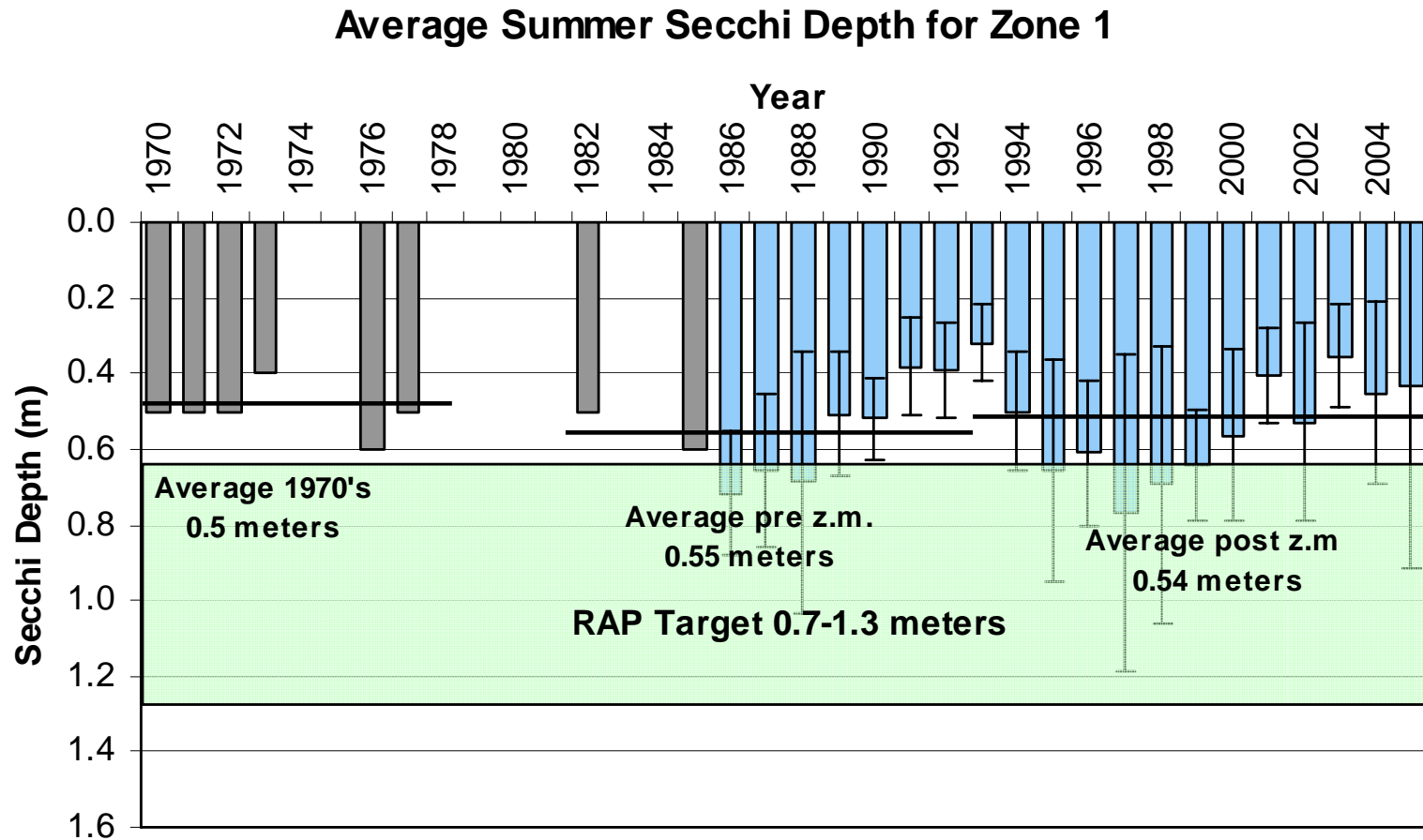
GBMSD Sampling Stations



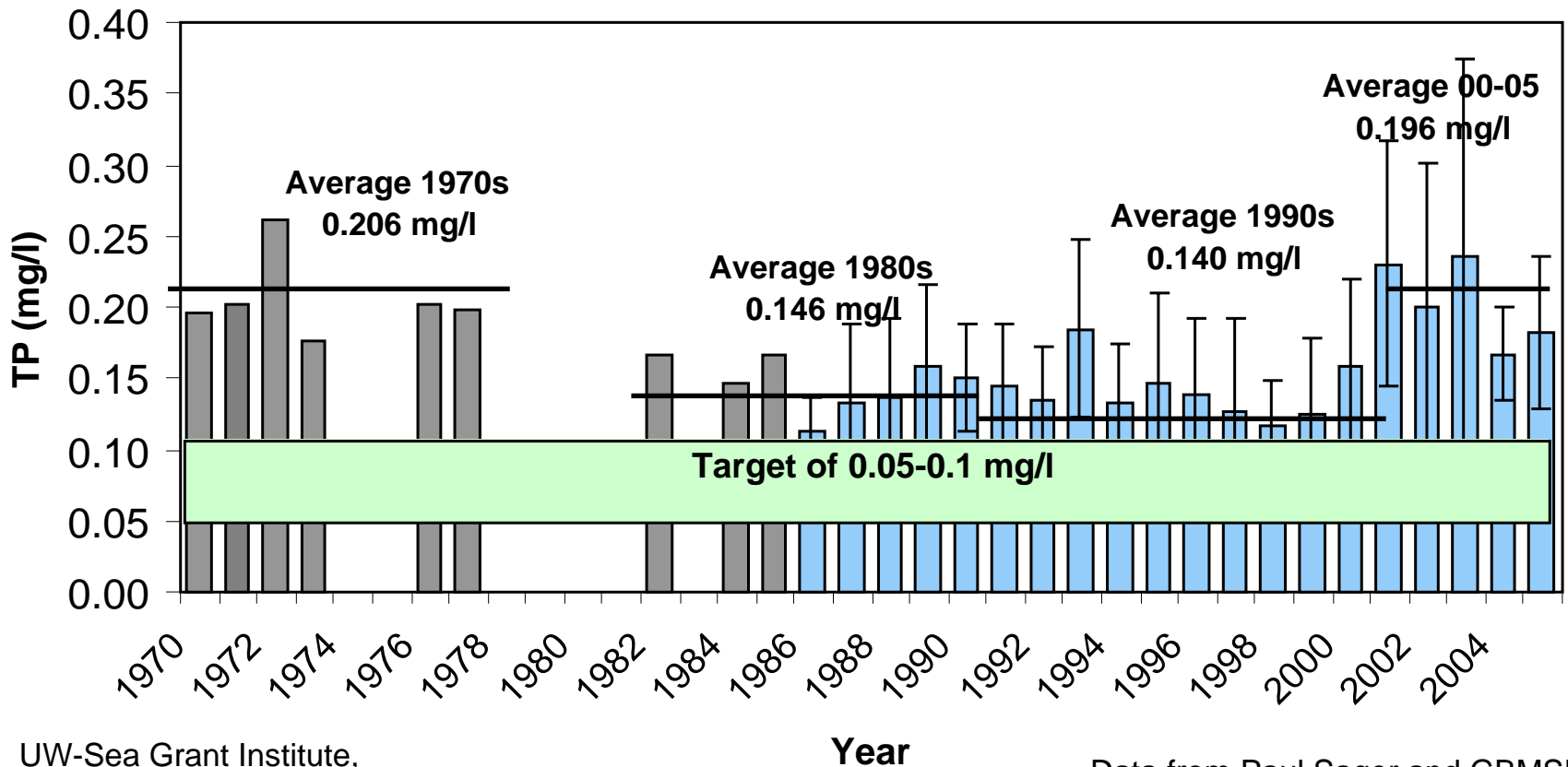
- 1986 to Present
- Weekly during May – October
- Surface and Bottom
- River stations and Bay zones 1 – 3
- **Secchi Depth, P, Chlor a, SS, N series,** DO profile, Temp, Cl

Lower Green Bay Secchi Depth (Water Clarity)

Status - Poor *Trend - Unchanged*



Average Summer TP Concentrations for Zone 1

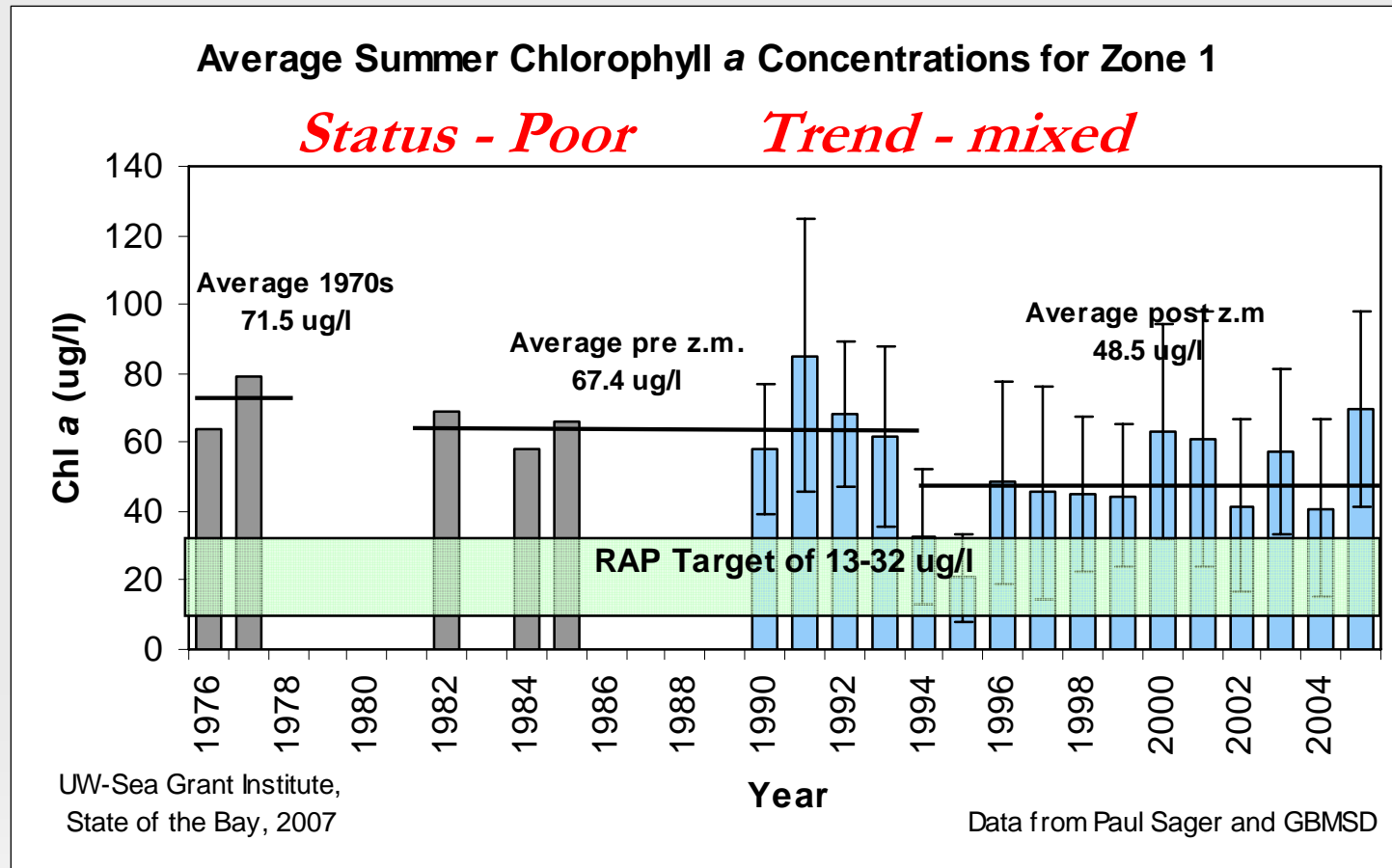


UW-Sea Grant Institute,
State of the Bay, 2007

Data from Paul Sager and GBMSD

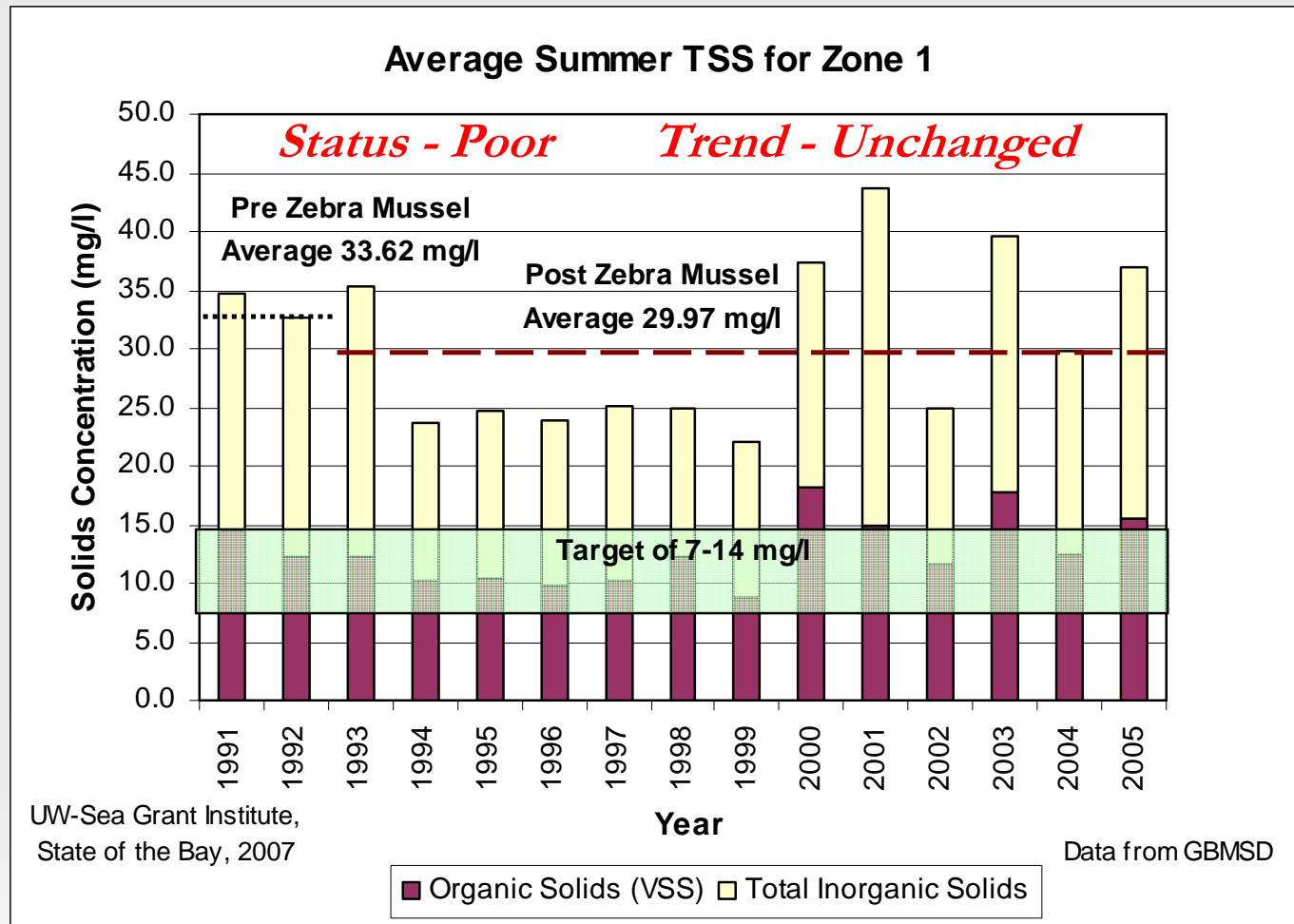
- Southern Green Bay AOC exceeds the RAP/STAC target
- Average TP concentrations increased by 18.1% in lower Green Bay post zebra mussels, while Fox R. loads remained about same
- 27 - 50% of phosphorus increase attributable to lower lake levels

Lower Green Bay Chlorophyll a



- Chl a concentrations decreased since zebra mussels were introduced (30% in zone 1 – 48% in zone 3)
- A decrease in TP to 100 ug/L would result in a chlorophyll a value of 30 ug/L and a reduction in blue-green algae of about 50 percent

Lower Green Bay Total Suspended Solids



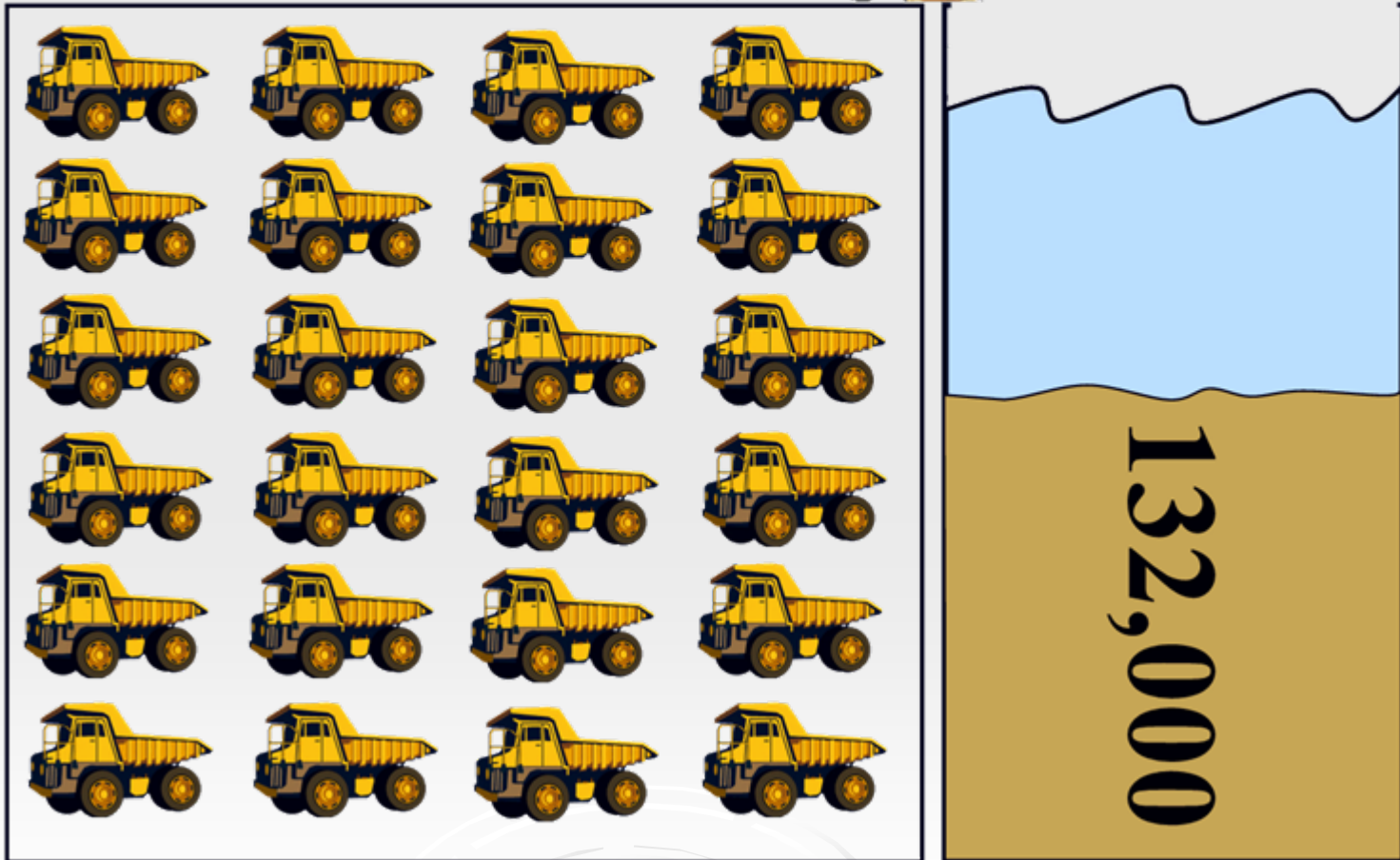
- TSS concentrations remain well above RAP targets.
- No significant change from 1991 – 2005 for all zones and river, but increases in both organic and inorganic solids during low water years

Sediment Deposited into Green Bay

24 Dump Trucks Per Day



132,000 tons per year!



About 60% of this annual load is delivered over 13-15 days of storm runoff

RAP Recommendation:

Reduce total suspended solids load from Fox River to Green Bay by 50%

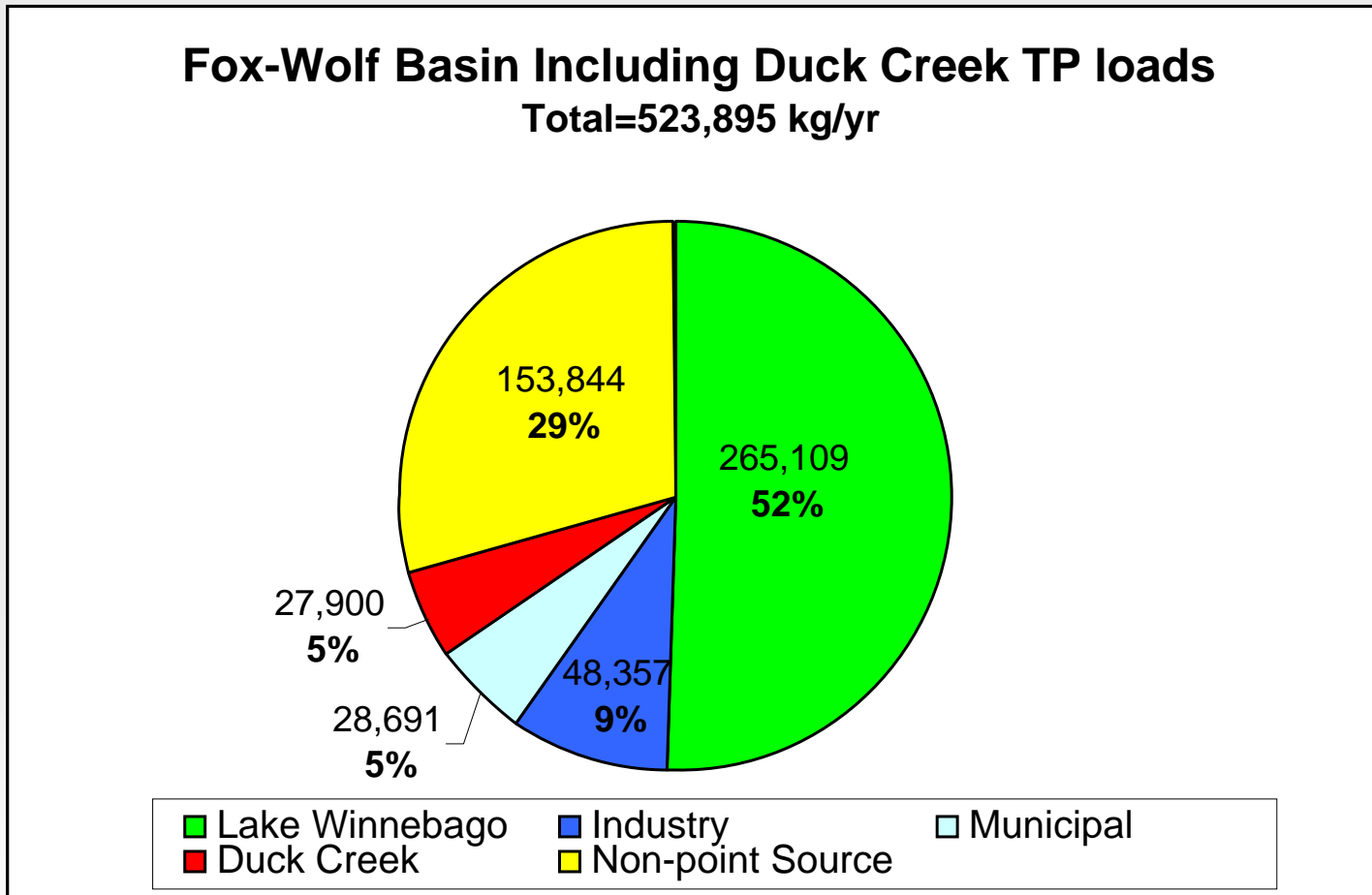


Agricultural land erosion




Construction site erosion

Total phosphorus loads for the Fox-Wolf basin including Duck Creek



Data and graph from TMDL draft report, 2005

An aerial photograph showing a river and a creek. The river is on the left, flowing towards the top left. The creek is on the right, flowing towards the bottom right. They meet in the center. The surrounding area is a mix of green fields, brown fields, and some buildings. A road runs along the bottom right. The text is overlaid on the top left of the image.

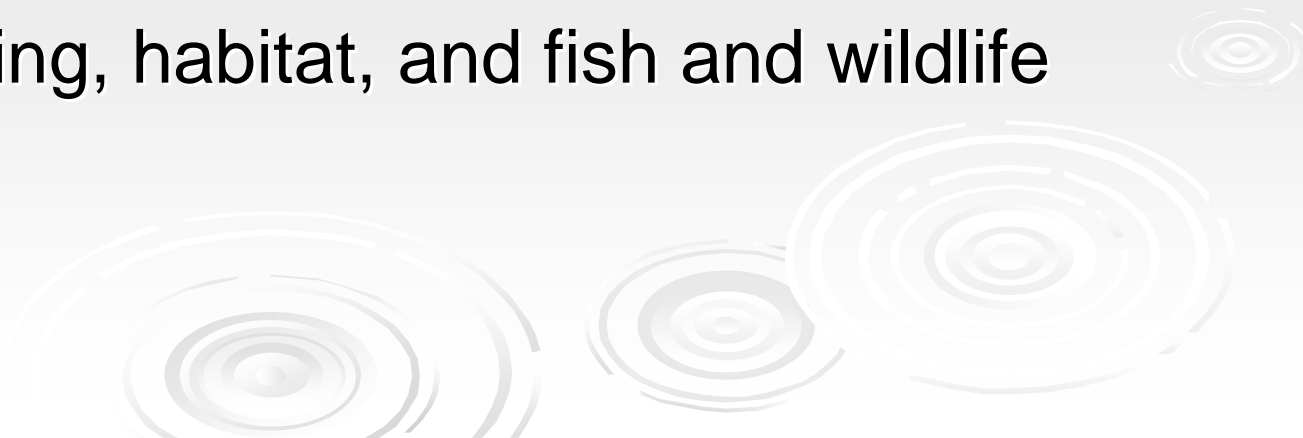
RAP Recommendation:
Reduce total phosphorus load from Fox River
to Green Bay by 50%

Fox River

Apple Creek

Conclusions

- Most use impairments in Lower Green Bay and Fox River are due to TP and TSS loads coming mainly from nonpoint sources
- RAP Targets for TP, TSS, Chlor *a*, and water clarity continue to be exceeded
- Substantial load reductions need to be allocated to a multitude of sources in the basin to restore safe swimming, habitat, and fish and wildlife populations



Questions?



"Knowledge is like manure. Put too much in one place, and it does no good. Spread it around, and everyone benefits." (unknown)